REMARKS

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended each of claims 1, 2 and 3 to emphasize that the conductive particles are only partially covered by insulating fine particles; that is, each of claims 1-3 has been amended to recite that remaining portions of surfaces of the conductive particles are not covered by the insulating fine particles. Note, for example, Figs. 1 and 2 of Applicants' original disclosure; see also, for example, claims 4, 19 and 20 thereof, previously reciting that in the covered particles, 5-60% of the surfaces of the conductive particles are covered by the insulating fine particles. Consistent with amendments to claims 1-3, claims 4, 19 and 20 have been amended to recite that remaining portions of the conductive particles are not covered by the insulating fine particles.

In addition, Applicants are adding new claims 49 and 50 to the application. Claim 50, dependent on claim 2, recites that the conductive particles comprise particles having a nucleus of a polymer and an outer layer of a precious metal. Note, for example, page 19 of Applicants' specification. Claim 49, dependent on claim 1, recites that the conductive particles comprise particles having a nucleus comprising a transition metal and an outer layer of a precious metal. Note, for example, page 21 of Applicants' specification.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed August 19, 2011, that is, the teachings of the U.S. patents to Fukuzawa, et al., No. 5,162,087, to Sugiyama, et al., No. 4,999,460 and to Hozoji, et al.,

No. 7,393,771, and Japanese Patent Document No. 3-112011 to Komatsu, et al., under the provisions of 35 USC 103.

Initially, attention is respectfully directed to Hozoji, et al., having a date, for prior art purposes, of November 24, 2004. However, note that the above-identified application claims priority under 35 USC 119 based upon Japanese Patent Application No. 2004-002305, filed January 7, 2004, and No. 2004-002308, also filed January 7, 2004, each prior to the date, for prior art purposes, of Hozoji, et al. Applicants have previously claimed priority based upon the two above-referred-to Japanese patent applications, and copies of the certified copies of the priority documents have been received in the above-identified National Stage application from the International Bureau, as set forth by the Examiner in the Office Action mailed August 19, 2011.

In addition, enclosed please find English translations of the two Japanese priority applications, together with verifications of the accuracy of each of the English translations. Accordingly, it is respectfully submitted that all formal requirements of 35 USC 119 and 37 CFR 1.55 have been satisfied, in connection with a claim for priority on each of the two above-referred-to Japanese patent applications.

Attention is respectfully directed to the enclosed English translations, and in particular pages 7-34 of the English translation of No. 2004-002305, particularly pages 7-10 thereof, and pages 7-32 of the English translation of No. 2004-002308, particularly page 7 thereof. As can be seen from the foregoing, as well as from a review of the two English translations as a whole, it is respectfully submitted that the Japanese priority applications of the above-identified application satisfy requirements of 35 USC 112, first paragraph, in connection with the presently claimed subject matter. Accordingly, it is respectfully submitted that the above-identified application

is to be accorded benefit of the filing dates of each of the Japanese priority applications, that is, January 4, 2004.

In view of all of the foregoing, it is respectfully submitted that Hozoji, et al. does not constitute prior art in connection with the presently claimed subject matter; and, accordingly, reconsideration and withdrawal thereof as prior art is respectfully requested. Accordingly, the rejection of claims 17, 45 and 46 under 35 USC 103(a), using the teachings of Hozoji, et al., among other references, must fall on this basis alone; and, accordingly, for purposes of conciseness, the teachings of Hozoji, et al., and the rejection of claims 17, 45 and 46 in view of the combined teachings of Fukuzawa, et al. and Hozoji, et al., will not be further discussed.

As for the remaining rejections, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit connecting material as in the present claims, for connection of the specified structure, and wherein the circuit connecting material comprises, in addition to an adhesive composition, covered particles comprising conductive particles with portions of their surface covered by insulating fine particles, remaining portions of surfaces of the conductive particles not being covered by the insulating fine particles (note each of claims 1-3); and, moreover, wherein the mass of the insulating fine particles constitutes 2/1000 to 26/1000 of the mass of the conductive particles (see claim 1), and/or wherein the conductive particles have nuclei comprising a polymer, and the mass of the insulating fine particles constitute 7/1000 to 86/1000 of the mass of the nuclei (see claim 2), and/or wherein the specific gravity of the covered particles is 97/100 to 99/100 of the specific gravity of the conductive particles (see claim 3).

By having the mass of the insulating fine particles as set forth in claim 1, the obtained circuit member connection structure has adequately reduced connection resistance between the opposing circuit electrodes and satisfactorily improved insulation between adjacent circuit electrodes. If the mass of the insulating fine particles is less than 2/1000 of the mass of the conductive particles, the conductive particles will not be adequately covered by the insulating fine particles; and if the mass of the insulating fine particles exceeds 26/1000 of the mass of the conductive particles, the insulating fine particles will be excessively covering the conductive particles, resulting in increased connection resistance of the conductive particles in the thickness of the circuit board when opposing circuit electrodes are connected together. Note sections [0009] and [0010] on pages 3 and 4 of Applicants' specification.

If the mass of the insulating fine particles is less than 7/1000 of the mass of the nuclei, the conductive particles will not be adequately covered by the insulating fine particles, so that the insulating property in the plane of the circuit boards will be unsatisfactory; and if the mass of the insulating fine particles exceeds 86/1000 of the mass of the nuclei, the insulating fine particles will be excessively covering the conductive particles. Note section [0012] on page 5 of Applicants' specification.

If the specific gravity of the covered particles is less than 97/100 of the specific gravity of the conductive particles, the insulating fine particles will be excessively covering the conductive particles, resulting in increased connection resistance; and if the specific gravity of the covered particles is greater than 99/100 of the specific gravity of the conductive particles, the conductive particles will not be adequately covered by the insulating fine particles, so that an insulating property in

the plane of the circuit boards will be unsatisfactory. Note section [0015] on page 6 of Applicants' specification.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit connecting material as in the present claims, with features as discussed previously in connection with claims 1-3, and, additionally, wherein 5-60% of the surfaces of the conductive particles are covered by the insulating fine particles. See claims 4, 19 and 20.

If less than 5% of the surfaces of the conductive particles is covered, the conductive particles will not be adequately covered, so that the insulating property in the plane of the circuit boards will be reduced; while if more than 60% of the surfaces of the conductive particles is covered with the insulating fine particles, electrical resistance in the thickness direction is increased.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit connecting material as in the present claims, with features as discussed previously in connection with claims 1-3, and, moreover, having a mean particle size of the insulating fine particles which is 1/40 to 1/10 of the mean particle size of the conductive particles. See claim 5; note also claims 21 and 22.

Using insulating fine particles with a mean particle size within the range set forth in the preceding paragraph, the surface of the conductive particles will be more readily covered by the insulating fine particles, resulting in further improved insulation in the plane of the circuit boards.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit

connecting material as in the present claims, having features as discussed previously in connection with claims 1-3, and, additionally, having further features as in the remaining dependent claims, including (but not limited to) material of the insulating fine particles (note, for example, claims 6, 22 and 23); and/or further definition of the adhesive composition, as in claims 7, 25 and 26; and/or wherein the connecting material further comprises a film-forming material, as in claims 8, 27 and 28, with further definition of the film-forming material as in claims 9, 10 and 29-32; and/or structure of the conductive particles, as in claims 49 and 50.

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit connecting material film, including the circuit connecting material according to claims 1-3. Note claims 11, 33 and 34.

Moreover, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such a circuit member connection structure, or such a method for fabrication of a circuit member connection structure, using the circuit connecting material of claims 1-3, as set forth in claims 12, 18, 35, 36, 47 and 48, with additional features of the circuit member connection structure and of the method of formation thereof as in the remaining dependent claims.

The present invention relates to a circuit connecting material, a circuit connecting material film including such material, a circuit member connection structure using such film or such material, and a process for fabrication of the connection structure using such material and film.

As described in section [0003] on pages 1 and 2 of Applicants' specification, with increased higher definitions of liquid crystal displays in recent years, gold bumps

serving as circuit electrodes in liquid crystal driving ICs have narrower pitches and smaller areas, causing problems of shorting by conductive particles in the circuit connecting material, and also causing a reduction of number of conductive particles held between opposing circuit electrodes such that electrical resistance between opposing circuit electrodes increases. While various techniques for solving these problems have been proposed, as described in section [0004] on page 2 of Applicants' specification, such proposed techniques have not been successful, particularly where electrode areas have further decreased.

Against this background, Applicants provide a circuit connection material, and uses thereof, wherein problems in connection with previously proposed connection materials are avoided; and, in particular, connection resistance between opposing circuit electrodes is reduced, with a satisfactory insulation property between adjacent circuit electrodes in a plane, on a circuit member, being achieved. Applicants have found that by utilizing covered conductive particles, wherein only a part of the surfaces of the conductive particles are covered with insulating fine particles, in the circuit connecting material, as recited in the present claims, problems in connection with previously proposed materials are avoided. In particular, utilizing covered conductive particles with only portions of the surfaces of the conductive particles being covered by insulating fine particles, and with relationships between (i) the mass of the insulating fine particles and mass of the conductive particles, (ii) mass of the insulating fine particles to the mass of polymer nuclei of the conductive fine particles, or (iii) specific gravity of the covered particles relative to the specific gravity of the conductive particles, as in the present claims, objectives according to the present invention are achieved, whereby reduction of electrical resistance between

connected electrodes is achieved, while providing sufficient resistance between adjacent electrodes in a plane.

Moreover, and as discussed in the foregoing, the claims have further features, such as percent of the surfaces of the conductive particles covered by the insulating fine particles and mean particle size of the insulating fine particles relative to that of the conductive particles, achieving further advantages for the present invention.

As to advantages achieved according to the present invention, attention is respectfully directed to the Examples and Comparative Examples in Applicants' specification, on pages 37-56 thereof. Note that Examples 1-3 and Comparative Examples 1 and 2 are set forth as a comparison for the First Embodiment of the present invention, with Examples 4 and 5 being set forth in comparison to Comparative Examples 3 and 4 for the Second Embodiment of the present invention. Note especially Table 3 on page 48 of Applicants' specification, and the discussion in connection therewith in sections [0165]-[0167] on pages 48 and 49 of Applicants' specification, and note Table 5 on page 55 of Applicants' specification and the description in connection therewith in sections [0189]-[0191] on pages 55 and 56 of Applicants' specification. The results shown in these Tables and the discussions in Applicants' specification respectively following these Tables, referred to in the foregoing, show unexpectedly better results achieved by the presently claimed invention.

It is respectfully submitted that this evidence must be considered in determining unobviousness of the presently claimed invention. See In re DeBlauwe, 222 USPQ 191 (CAFC 1984). Properly considered, it is respectfully submitted that this evidence supports a conclusion of unobviousness of the presently claimed subject matter.

Fukuzawa, et al. discloses anisotropic conductive adhesive compositions for use in bonding printed circuit boards, containing an insulating adhesive component and particles dispersed in the insulating adhesive component, the compositions being characterized in that the insulating adhesive component comprises a copolymer of acrylic ester having an alkyl group of 1-4 carbon atoms and a maleimide derivative, and specified amounts of a thermosetting resin and a coupling agent, and wherein the particles dispersed in the insulating adhesive component are metallic-layer containing particles comprising a core made of a resin, a metallic layer covering the core and a resin layer formed from finely divided resin fixed by the dry blending method on the surface of the metallic layer. Note column 3, lines 31-49. See also column 3, lines 63-68; and column 4, lines 12-17, describing that the metallic-layer containing particles will come to exhibit conductibility when the resin layer constituting the outer shell of the metallic layer containing particles is destroyed at the time of contacting, heating and bonding two pieces of printed circuit boards together. See also column 7, lines 31-35, together with Fig. 1, describing that the particles used in the anisotropic conductive adhesive compositions are composed of a core 7 made of resin, a metallic layer 9 covering the core 7 and a resin layer covering the metallic layer 9. Note also column 8, lines 49-54; and column 9, lines 33-39 and 58-62 of this patent. As indicated in column 9, the resin layer (resin layer 11) is formed by mixing the core 7 having the metallic layer 9 thereon and the particulate resin 15 together, with, e.g., compression force, shearing force or impact force being applied thereto.

It is emphasized that the particles included in the adhesive composition in Fukuzawa, et al. are the lower particles shown in Fig. 1, that is, with a layer of material formed from the particulate resin 15 (that is, resin layer 11, not particulate

15) included in the adhesive composition. It is emphasized that the upper structure in Fig. 1, with resin particles 15, is not the particulate included in the adhesive composition. As can be appreciated from the lower structure in Fig. 1, the resin layer 11 covers the entirety, in substance, of the particle surface. It is respectfully submitted that the disclosure of this reference, either alone or in combination with the disclosures of the other references as applied by the Examiner, would have taught away from the presently claimed invention, including wherein the insulating fine particles cover only a portion of the conductive particles, as in all of the present claims; and, moreover, wherein the mass of the insulating fine particles relative to the mass of the conductive particles, or mass of the insulating fine particles relative to the mass of the nuclei, or specific gravity of the covered particles relative to that of the conductive particles, is that set forth in the present claims, and advantages thereof; and/or other features of the present invention as in the present claims, and advantages thereof, as discussed in the foregoing. In this regard, it is respectfully submitted that Fukuzawa, et al. provides no disclosure in connection with the structure recited in the last two lines of each of claims 1-3.

On page 2 of the Office Action mailed August 19, 2011, the Examiner contends that Fukuzawa, et al. teaches conductive particles with portions of their surfaces covered by insulating fine particles, the Examiner referring to element 15 in Fig. 1 of this reference. It must be emphasized that the structure represented by reference character 15 in Fig. 1 is not included in the adhesive composition; but rather, the structure represented by reference character 15 is further processed to form resin layer 11, this resin layer 11 forming part of the particle incorporated in the adhesive composition. Thus, it is respectfully submitted that Fukuzawa, et al. would

have taught away from the presently claimed subject matter, including features as discussed in the foregoing.

The contentions by the Examiner in the first two paragraphs on page 3 of the Office Action mailed August 19, 2011, are respectfully traversed. It is respectfully submitted that the teachings of Fukuzawa, et al. do not mention the ratios as in the last two lines of each of claims 1-3, or that these ratios are result-effecting parameters. The applied prior art, including Fukuzawa, et al., would have neither disclosed nor suggested such ratios, and advantages thereof, as discussed in the foregoing.

In connection with claims 14, 39 and 40, Komatsu, et al. discloses an anisotropic conductive material, wherein the insulating grains in the adhesive are pressed to such an extent that the conductive grains 5 attached to the surface thereof are diffused in a signal layer; and with pressure applied such that the insulating grains attached to the sides at both the electrodes are removed from the conductive grains, with the result that the upper and lower portions of the conductive grains come into contact with both the electrodes, and the electrodes are electrically connected.

It is respectfully submitted that Komatsu, et al. has insulating grains surrounding the entirety of the conductive grains 5, in the connecting material (e.g., prior to connecting opposed electrodes). The disclosure of this patent, even when taken in combination with the teachings of Fukuzawa, et al., would have neither disclosed nor would have suggested the fine insulating grains covering only a portion of the conductive particles in the circuit connecting material, and advantages thereof; and/or other features of the present invention as discussed in the foregoing.

In connection with claims 4, 16, 19, 20, 43 and 44, Sugiyama, et al. discloses conductive connecting structure comprising a first connection terminal, a second connecting terminal arranged to oppose the first connecting terminal, a plurality of fine connecting particles interposed between the first and second connecting terminals, each of the fine connecting particles including a fine particle having an electric conductivity at least in a surface thereof, and an insulating layer consisting of a material having a relatively low melting point and covering substantially the entire surface of the fine particle, and an insulating adhesive filled in a gap between the first and second connecting terminals, wherein only portions of the insulating layer covering the surface of each fine particle which oppose the first and second connecting terminals are broken, and the first and second connecting terminals are electrically connected to each other through the particle exposed from the broken portions. See column 3, lines 24-42. Note further description of the resin layer of each fine connecting particle, in column 4, lines 50-63, emphasizing that the resin layer is composed of a low-melting material and is designed such that a portion in the direction of thickness is broken due to a thermal compression force acting on the bonding agent, and a portion in the planar direction remains. Note, further, column 5, lines 38-63; and column 6, lines 15-26.

It is emphasized that Sugiyama, et al. discloses the insulating layer covering substantially the entire surface of the fine particle having electric conductivity. It is respectfully submitted that such disclosure in Sugiyama, et al., particularly in combination with the teachings of Fukuzawa, et al., would have taught away from the presently claimed invention, including extent of the insulating fine particles covering the conductive particles, or other features of the present invention as in the last two

lines in each of claims 1, 2 and 3, or other features of the present invention as discussed in the foregoing, and advantages thereof.

In particular, it is respectfully submitted that Fukuzawa, et al. and Sugiyama, et al., each describing that substantially the entire surface of the conductive particles is covered by the insulating layer, would have taught away from wherein 5-60% of the surfaces of the conductive particles are covered by the insulating fine particles, as in various of the present claims, and advantages thereof.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims in the above-identified application are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (case 1303.46354X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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